703,563 COMPLETE SPECIFICATION
1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

Fig. 1

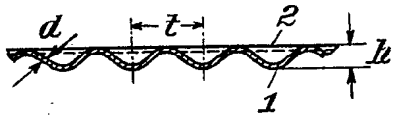


Fig. 2

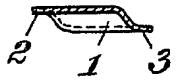


Fig. 3

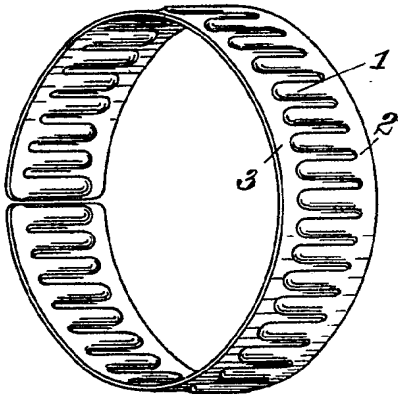


Fig. 4

Fig. 5

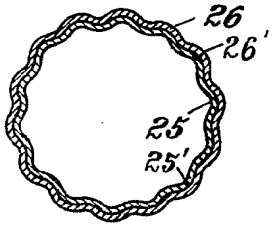


Fig. 6

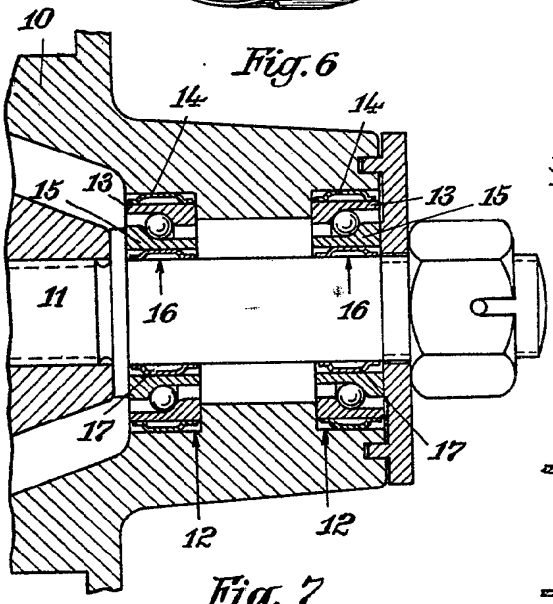


Fig. 8

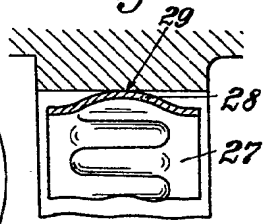


Fig. 9

Fig. 10

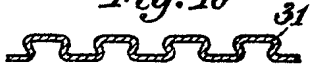


Fig. 7

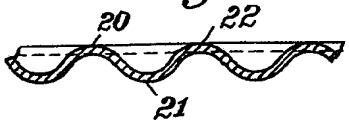
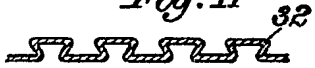


Fig. 11



PATENT SPECIFICATION

703,563

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COMPLETE SPECIFICATION

Improvements in or relating to Seatings for Machine Parts

We, DEUTSCHE STAR KUGELHALTER, Ges.m.b.H., a Body Corporate organised and existing under the laws of the Federal Republic of Germany, of Schweinfurt, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to means for seating one member of a machine or device upon or within another, more particularly the invention relates to undulating or corrugated springy sheet metal ribbons for the said purposes.

Springy ribbons according to the invention are generally useful for seating two members of a machine or device, one upon the other or one within the other, with any desired seating, that is, the two members may be stationarily seated with a tight fit or a loose fit or the two members may be slidably seated upon or within each other. A particularly advantageous and now preferred field of application is the mounting of the races of ball, roller or needle bearings upon a shaft and within the bore of the machine or device for the bearing.

Practical experience shows that considerable time, elaborate devices and measuring instruments are required to produce the aforementioned types of seating if high demands as to the accuracy of the seatings are made. In this case, dimensions of the engaging surfaces of the machine parts must be maintained with very high accuracy, that is, very narrow tolerances must be kept. It is well known that manufacturing costs increase disproportionately with decreasing tolerances.

It has already been proposed to mount machine parts on rotary shafts by means of corrugated springy ribbons or strips. However, this method of mounting has not been used as yet in the practice to any appreciable extent. To seat machine parts upon or within other parts with a definite type of seat, the springy ribbon must be fitted between the parts to be seated with considerable pressure in order to obtain the required force of adherence. The pressures used are frequently in the magnitude of several tons. This causes considerable difficulty or it is even impossible with corrugated ribbons or bands as hitherto known since very slight tilting of the ribbons causes the same to become set in the shafts or bores of the machine parts. Furthermore, a non-uniform deformation of the ribbons when the same are inserted or pressed in is or may already be sufficient to prevent a centric seating of the machine parts.

Accordingly, one of the principal objects of the invention is to provide a novel and improved corrugated or undulating springy sheet metal ribbon which is so designed that a smooth and uniform fitting of the ribbon between the two members to be seated upon or within each other is greatly facilitated.

Another more specific objects of the invention is to provide a springy ribbon of the general type, above referred to, which is stiffened, particularly at the ends of the corrugations of the ribbon, so that non-uniform deformations of the ribbon along the edges thereof when the same is fitted between the two members are prevented or at least greatly impeded.

According to the invention, a seating means for seating two members upon or within each other, comprises a ribbon of springy sheet metal curved along its longitudinal axis to form a sleeve with the ends of the ribbon juxtaposed and having a smooth marginal portion extending around the sleeve and a corrugated portion between the smooth marginal portion and the opposite edge of the sleeves, the sequence of the undulations of the corrugated portion being longitudinal in relation to said ribbon.

In order that the invention shall be

[*Price* 2/8]

Price 3s. 6d.

Price 4s 6d. Price 2s

Price 75p

clearly understood, a preferred embodiment thereof will now be described by way of example with reference to the accompanying diagrammatic drawings, in which:—

Fig. 1 is a fragmentary longitudinal section of a springy ribbon according to the invention on an enlarged scale;

Fig. 2 is a cross-section of Fig. 1;

Fig. 3 is a perspective view of a sleeve-shaped ribbon according to the invention;

Fig. 4 is a fragmentary view of the abutting ends of a sleeve-shaped ribbon;

Fig. 5 is a cross-section of a composite sleeve-shaped ribbon according to the invention;

Fig. 6 is a sectional view of a bearing arrangement employing springy sleeves according to the invention for seating the bearing;

Fig. 7 is a fragmentary sectional view of a modification of a ribbon according to the invention on an enlarged scale;

Fig. 8 is a fragmentary view of a machine part and of a ribbon according to the invention fitted into the said machine part; and

Figs. 9 to 11 inclusive are fragmentary cross-sectional views of three modifications of ribbons according to the invention on an enlarged scale.

Referring first to Figs. 1 and 2 in detail, these figures show a springy sheet metal ribbon made for instance of steel. This ribbon has a longitudinally corrugated or undulating centre or inner portion 1 and two outer or marginal smooth portions 2 and 3. As a result, the stiffness of the ribbon in its entirety and particularly at the ends of the corrugations are considerably increased. An increase of the stiffness and general strength of the ribbon is particularly important at or near the corrugations and specifically at the short edges thereof since these edges are subject to a particularly high stress when the ribbons are pressed into position.

The increased stiffness of the ribbon permits the use of very thin sheet metal in their manufacture and the corrugations or waves can be produced by pressing or dishing an originally smooth ribbon.

The two smooth portions 2 and 3 can be of the same diameter as the median diameter of the corrugations or they can be of different diameters so that they are flush either with the peaks or the bases of the corrugations or are in a plane between the peaks and the bases of the corrugations. The portions 2 and 3 facilitate the insertion of the ribbons, assuming that the same are sleeve-shaped as will be more fully explained hereinafter—when the smooth portion at the foremost side, as seen in the direction of the insertion, has a diameter smaller than the respective bore and larger than the respective diameter of the shaft in case cylindrical machine parts are to be seated in bearings. Then the other smooth portion of the ribbon which now forms the back of the aforementioned sleeve forms a plane abutment for the tool transmitting the fitting pressure to the sleeve. As previously mentioned, an abutment of this type is of vital importance for a uniform fitting of the sleeves since fitting pressures in the order of several tons must be transmitted to the ribbon sleeve.

Fig. 3 shows a sleeve formed by a ribbon as shown in Figs. 1 and 2. Accordingly, identical portions of the sleeve are designated by similar reference characters.

When a machine part, for instance, the outer race of a roller or ball bearing, is to be seated in a bore by means of a springy sleeve according to Fig. 3, the corrugations of the inner portion 1 are pressed in radial direction. Experience and tests show that it is very essential for the properties and the quality of the bearing how the very considerable radial forces are absorbed, that is, whether they are absorbed by the bore and the springy sleeve or also by the outer race of the bearing or only by the said race and the springy sleeve. Depending upon the absorption of these radial forces, forces of adherence are produced between the springy sleeve and the bearing race in the longitudinal direction of the springy sleeve and in the circumferential direction thereof. These forces of adherence are either between the sleeve and the bore or between the sleeve and the outer race of the bearing.

The magnitude of the radial forces which are created when a springy sleeve according to the invention is pressed between the two respective members to be seated is determined on the one hand by the thickness of the gap between the members to be seated and on the other hand by the thickness of the material of the springy ribbon or sleeve, by the type of the material, by the magnitude of the distance **t** and by the amplitude and shape of the corrugations. The manner in which these forces are absorbed, for instance, when cylindrical machine parts are to be seated, is dependent upon whether the front edges of a springy sleeve abut against each other or not when the sleeve is pressed into position. If a gap remains between the said front edges the radial forces are absorbed by the bore and the inserted member, for instance the outer race of a roller bearing. Then, a force of adherence in longitudinal direction is developed between the two machine parts and the sleeve. This force is determined by the strength of the required fitting pressure and the distribution of the longitudinal force of adherence relative to the bore and the outer race of the bearing is influenced by the configuration of the corrugations of the springy sleeve. Essentially, the radial forces are absorbed by the bearing race, that is, in case of seat- of roller bearings such bearings must have

the customary play to avoid a jamming or setting of the bearing.

If the total length of the springy ribbon forming the sleeve is so selected that the front edges thereof abut against each other under pressure, the radial forces are exclusively absorbed by the bore and the springy sleeve, that is, the desired longitudinal force of adherence is created between the sleeve and the bore while the race of the bearing is not subject to a radial force. Sleeves of such type have the advantage that roller bearings or ball bearings without play can be employed.

In order to make certain that under the last mentioned conditions the front edges abut against each other in case very thin sheet metal is used for the sleeves, the front edges of the sleeves can be shaped as shown in Fig. 4 in which the front edge portions of a sleeve 24 are bent off inwardly.

In this connection, it should also be mentioned that it has been found advantageous to round out the edges of the sleeve at 23. Practical tests and experience show that in case of comparatively sharp edges the required fitting pressures increase appreciably without a corresponding increase of the forces of adherence.

In case it is desired to develop a low longitudinal force of adherence between the springy sleeve and the bore and a high longitudinal force of adherence between the springy sleeve and the machine part encompassed by the ring, it is advantageous to use a sleeve according to Fig. 5. This figure shows a sleeve composed of two concentric nested sleeves 25 and 26 which are so disposed that the respective butt edges 25′ and 26′ are circumferentially displaced relative to each other. The outer sleeve 26 cannot spread due to the bore in which it is inserted and also prevents by its corrugations a circumferential relative movement of the inner sleeve. In other words, the inner sleeve 25 functions as an endless sleeve so that the radial forces are transmitted exclusively to the inner sleeve and a shaft when the sleeve is pressed upon the shaft. In other words, a high force of adherence is developed between the shaft and the sleeve while the longitudinal force of adherence between the outer sleeve and the bore for seating the same remains low.

Fig. 6 shows an arrangement in which the races of ball bearings are mounted by means of springy means according to the invention. There is shown a hub-shaped machine part 10 in which a rotary shaft 11 is journalled by means of two ball bearings. Each bearing comprises an outer race 13 and an inner race 15 between which the balls of the bearing can rotate. The hub 10 is provided with two radial bores 12 which serve as seating surfaces for the outer races 13. The diameter of these bores 12 provides the usual tolerance. The outer races are pressed into bores 12 together with springy sleeves 14. The dimensions *d*, *t*, and *h* (see Fig. 1) of sleeves 14 are selected in accordance with the desired fitting pressure. Similarly, the inner races 15 are fitted upon the seating surfaces 16 of shaft 11 by interposing springy sleeves 17. The seating surfaces of shaft 11 and the diameter of the shaft at the said seating surfaces can be manufactured with the usual comparatively wide tolerances so that the machining of the surfaces in question does not offer any difficulties. The invention affords the additional advantage that the diameter of the shaft at the seating surfaces may be the same as the general diameter of the shaft. Hence, it is not necessary to provide special seating surfaces having a larger diameter than the general diameter of the shaft.

The provision and use of springy sleeves according to the invention for the seating and mounting of bearings such as ball bearings, has also the advantage that it is no longer necessary to employ bearings with play since any deformation of the cages of the bearings is avoided when springy sleeves according to the invention are used. Furthermore, the invention permits the seating of machine parts made of different metals upon and within each other since different coefficients of expansion of the two parts are compensated for by the springiness of the sleeves. In case comparatively soft metals are used, the sleeves according to the invention make certain that a sufficient pressure for forcing the sleeves into position and out of position is available when the bearing assembly is repeatedly assembled and disassembled.

Springy sleeves according to the invention the suitable for mounting parts of any configuration and permit applying any desired or necessary pressure for pressing the sleeves and other parts into and out of position.

Fig. 7 shows a longitudinal section of a springy ribbon according to the invention which is formed by two nested corrugated sheet metal strips 20 and 21 separated by a layer 22 of a suitable resilient material which fills the space between the two metal strips. The resilient layer, for instance a rubber-like synthetic resin, serves to suppress noise and oscillation. The thickness of the strips and the layer may be a few tenths of a millimetre.

Fig. 8 shows a springy sleeve 27, the corrugations 28 of which are slightly convex so that the sleeve abuts against the bore of the machine part 36 in which it is inserted only along a comparatively narrow annular surface 29. Springy sleeves of this type are particularly suitable for journalling long shafts in several bearings, for instance, the

crank shafts as used in sewing machines. The bearings used for this purpose must be mounted in very accurate alignment and there is always the danger that the bearings become disaligned due to subsequent operations, for instance, due to heating during the application of lacquer or enamel and the following drying. Realignment of the bearings is generally tedious and expensive. Mounting of the crankshaft by means of springy sleeves according to Fig. 8 generally eliminates the necessity of realignment.

As already mentioned, the radial forces causing a deformation of the springy sleeves can be influenced by the original configuration of the sleeves.

Fig. 9 shows an embodiment of the invention in which the corrugations of a springy ribbon 30 are approximately triangularly shaped.

Fig. 10 shows a springy ribbon 31 with substantially trapezoidal or meander-shaped corrugations.

Fig. 11 shows a springy ribbon 32 with dovetailed corrugations.

While the invention has been described in detail with respect to certain now preferred examples and embodiments of the invention, it will be understood by those skilled in the art after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, to cover all such changes and modifications within the scope of the appended claims.

What we claim is:—

1. A seating means for seating two members upon or within each other, comprising a ribbon of springy sheet metal curved along its longitudinal axis to form a sleeve with the ends of the ribbon juxtaposed and having a smooth marginal portion extending around the sleeve and a corrugated portion between the smooth marginal portion and the opposite edge of the sleeve, the sequence of the undulations of the corrugated portion being longitudinal in relation to said ribbon.

2. A seating means for seating two members upon or within each other, comprising a ribbon of springy sheet metal curved along its longitudinal axis to form a sleeve with the ends of the ribbon juxtaposed and having a smooth marginal portion extending around the sleeve from each edge thereof, and an intermediate corrugated portion, the sequence of the undulations of the corrugated portion being longitudinal in relation to said ribbon.

3. A seating means as defined in Claim 2, wherein the diameters of said two marginal portions are equal to the median diameter of the corrugations of the sleeve.

4. A seating means as defined in Claim 2, wherein the diameters of said two marginal portions are different from the median diameter of the corrugations of the sleeve.

5. A seating means as defined in Claim 2, wherein the outer ends of the corrugations are smoothly rounded.

6. A seating means as defined in Claim 2, wherein said corrugations are slightly convex in the direction of the longitudinal axis of the sleeve.

7. A seating means as defined in Claim 2, wherein the corrugations have a substantially triangular cross-section.

8. A seating means as defined in Claim 2, wherein the corrugations have a substantially trapezoidal cross-section.

9. A seating means as defined in Claim 2, wherein the corrugations have a substantially dovetailed cross-section.

10. A seating means as defined in Claim 2, wherein the abutting ends of the slotted sleeve are inwardly bent to form rounded butt edges.

11. A seating means for seating two members upon and within each other, comprising at least two nested sleeves, each of which is formed from a ribbon of springy sheet metal curved along its longitudinal axis with the ends of the ribbon juxtaposed and has a smooth marginal portion extending around the sleeve from each edge thereof, and an intermediate corrugated portion, the sequence of the undulations of which is longitudinal in relation to said ribbon; the abutting ends of the two ribbons forming the sleeves being staggered.

12. A seating means for seating two members upon and within each other, comprising at least two sleeves, each of which is formed from a ribbon of springy sheet metal curved along its longitudinal axis with the ends of the ribbon juxtaposed, and has a smooth marginal portion extending around the sleeve from each edge thereof, and an intermediate corrugated portion, the sequence of the undulations of which is longitudinal in relation to said ribbon, the said sleeves being concentrically disposed spaced apart, and a layer of resilient material filling the space between the said sleeves.

13. A seating means as defined in Claim 11, wherein said resilient layer is formed by a synthetic resin.

14. In a bearing installation for journalling a rotary shaft in a machine part by means of a bearing including bearing elements movable between an inner and an outer race, seating means for the said bearing comprising two sleeves each of which is formed from a ribbon of springy sheet metal curved along its longitudinal axis with the ends of the ribbon juxtaposed, and has a smooth marginal portion extending around the sleeve from each edge thereof, and an intermediate corrugated portion, the sequence of the undulations of which is longi-

tudinal in relation to said ribbon, one of said sleeves being tightly fitted between the outer race and said machine part and the other sleeve being tightly fitted between said inner race and said shaft.

15. Seating means for seating two members upon and within each other, substantially as described with reference to the accompanying drawings.

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